

08/17/00

jc912 U.S. PTO

08-21-00

A

**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Only for new nonprovisional applications under 37 CFR 1.53(b))**

jc912 U.S. PTO  
 08/17/00  
 09/641987

Docket No. : 40055/DBP/Y35  
 Inventor(s) : Yang-Woon Na  
 Title : FLAT PANEL DISPLAY  
 Express Mail Label No. : EL366457823US

**ADDRESS TO:** Assistant Commissioner for Patents  
 Box Patent Application  
 Washington, D.C. 20231

Date: August 17, 2000

1. ☒ **FEE TRANSMITTAL FORM** *(Submit an original, and a duplicate for fee processing).*

2. **IF A CONTINUING APPLICATION**

\_\_\_ This application is a of patent application No. .

Prior application information: Examiner ; Group Art Unit:

\_\_\_ This application claims priority pursuant to 35 U.S.C. §119(e) and 37 CFR §1.78(a)(4),  
 to provisional Application No. .

3. **APPLICATION COMPRISED OF**

**Specification**

11 Specification, claims and Abstract (total pages)

**Drawings**

3 Sheets of drawing(s) (FIGS. 1 to 3)

**Declaration and Power of Attorney**

☒ Newly executed

\_\_\_ Unexecuted declaration

\_\_\_ Copy from a prior application (37 CFR 1.63(d))(for continuation and divisional)

4. \_\_\_ **Microfiche Computer Program** *(Appendix)*

5. \_\_\_ **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, all necessary)*

\_\_\_ Computer Readable Copy

\_\_\_ Paper Copy (identical to computer copy)

\_\_\_ Statement verifying identity of above copies

6. **ALSO ENCLOSED ARE**

\_\_\_ Preliminary Amendment

\_\_\_ A Petition for Extension of Time for the parent application and the required fee are  
 enclosed as separate papers

\_\_\_ Small Entity Statement(s)

\_\_\_ Statement filed in parent application, status still proper and desired

\_\_\_ Copy of Statement filed in provisional application, status still proper and desired

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**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Only for new nonprovisional applications under 37 CFR 1.53(b))**

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Docket No.: 40055/DBP/Y35

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- X An Assignment of the invention with the Recordation Cover Sheet and the recordation fee are enclosed as separate papers
- This application is owned by pursuant to an Assignment recorded at Reel , Frame
- X Information Disclosure Statement (IDS)/PTO-1449
- X Copies of IDS Citations
- X Certified copy of Priority Document(s) (*if foreign priority is claimed*)
- English Translation Document (*if applicable*)
- X Return Receipt Postcard (MPEP 503) (should be specifically itemized).
- Other

**7. CORRESPONDENCE ADDRESS**

***CHRISTIE, PARKER & HALE, LLP, P.O. BOX 7068, PASADENA, CA 91109-7068***

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By *D. Bruce Prout*  
D. Bruce Prout  
Reg. No. 20,958  
626/795-9900

DBP/aam

**FEE TRANSMITTAL  
UTILITY PATENT APPLICATION**

**DATE: August 17, 2000**

Docket No. : 40055/DBP/Y35  
Inventor(s) : Yang-Woon Na  
Title : FLAT PANEL DISPLAY

FEE CALCULATIONS					
CLAIMS		NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS
A	TOTAL CLAIMS	17 - 20 =	0	0 x \$9.00.	\$0.0
B	INDEPENDENT CLAIMS	1 - 3 =	0	0 x \$39.00.	
C	SUBTOTAL			SMALL ENTITY FEE = A + B LARGE ENTITY FEE = 2 X (A + B)	0.0
D	BASIC FEE			SMALL ENTITY FEE = \$345.00 LARGE ENTITY FEE = \$690.00	690.00
E	MULTIPLE-DEPENDENT CLAIMS FEE			SMALL ENTITY FEE = \$130.00 LARGE ENTITY FEE = \$260.00	0.0
F	TOTAL FILING FEE (ADD LINES C, D, AND E)				\$690.00
List Independent Claims: 1					

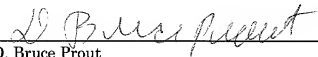
**METHOD OF PAYMENT**

☒ Payment Enclosed: Check for \$690.00

☒ The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required during the **entire pendency** of the application to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account. **A duplicate copy of this sheet is enclosed.**

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By   
D. Bruce Prout  
Reg. No. 20,958  
626/795-9900

00641937.081700

**FLAT PANEL DISPLAY****BACKGROUND OF THE INVENTION****(a) Field of the Invention**

5           The present invention relates to a flat panel display and, more particularly, to a flat panel display which has spacers for maintaining the cell gap in a constant manner.

**(b) Description of the Related Art**

10           Generally, flat panel displays (FPDs) have a faceplate, a backplate, and a side wall that are combined together to form a vacuum tight cell. The vacuum degree of the cell is established to be about  $10^{-7}$  torr.

15           In such a flat panel display, compared to other display devices, it is difficult to constantly maintain the cell gap due to the difference between the internal pressure and the external atmospheric pressure. For this reason, one or more spacers are provided within the cell to maintain the cell gap in a constant manner.

20           U. S. Patent No. 5,650,690 or 5,543,683 discloses a method of fabricating a field emission display that has a gripper disposed on the faceplate, a locator disposed on the backplate, and a spacer wall interposed between the gripper and the locator. The spacer wall for securing the internal space of the device is formed with ceramic or glass, and interposed between the faceplate and the backplate via the gripper and the locator.

However, in the above structure, the gripper and the locator for holding the spacer wall should be separately provided, resulting in increased production cost and complicated processing steps (for example, photolithography for a photosensitive material).

Furthermore, in order to fit the spacer wall between the gripper and the locator, each spacer should be inserted into the gripper or the locator. This requires elaborate working conditions while making it difficult to maximize work efficiency.

### **SUMMARY OF THE INVENTION**

It is an object of the present invention to provide a flat panel display which can mount spacers without separate fixation members.

It is another object of the present invention to provide a flat panel display which can be fabricated in a simplified manner.

These and other objects may be achieved by a flat panel display including a faceplate, and a backplate combined with the faceplate to form a vacuum tight cell. An image production unit is provided within the cell to produce display images from the cell. A plurality of spacers are mounted within the cell such that the spaces are placed at a non-display area. The spacers are held between the faceplate and the backplate. A pair of alignment members are connected to the spacers in a body to align the spacers at the non-display area in a constant manner.

Each alignment member is connected to one-sided end portions of the

spacers. The spacers are longitudinally placed along each one side of the plates parallel to each other.

A pair of subsidiary alignment members may be arranged perpendicular to the alignment members to form a rectangular frame.

Each spacer is provided with a plurality of exhaust grooves. The exhaust grooves are arranged at the spacer in the longitudinal direction while being spaced apart from each other with a predetermined distance.

Each spacer may be further provided with a plurality of grooves for preventing image distortion. The image distortion preventing grooves are arranged at the spacer in the longitudinal direction while being spaced apart from each other with a predetermined distance.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or the similar components, wherein:

Fig. 1 is a cross sectional view of a flat panel display according to a preferred embodiment of the present invention;

Fig. 2 is a perspective view of a spacer structure for the flat panel display shown in Fig. 1; and

Fig. 3 is a perspective view of a spacer structure fixed to a plate for the

flat panel display shown in Fig. 1.

## **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Preferred embodiments of this invention will be explained with reference to the accompanying drawings.

5 Fig. 1 is a cross sectional view of a flat panel display according to a preferred embodiment of the present invention where a field emission display (FED) is exemplified as the flat panel display.

10 The field emission display includes a faceplate 1, and a backplate 3 spaced apart from the faceplate 1 with a predetermined distance while proceeding parallel thereto. The faceplate 1 is combined with the backplate 3 to thereby form a vacuum tight cell.

15 The faceplate 1 is sequentially overlaid with an anode electrode 1a, and a plurality of phosphor layers 1b placed at an even plane with a predetermined pattern. A black matrix 1c surrounds the phosphorous layers 1b to improve contrast, and formed with chrome (Cr) or chrome/chrome oxide layer (Cr/CrO<sub>2</sub>).

20 The backplate 3 is overlaid with a plurality of cathode electrodes 3a placed at an even plane with a stripe pattern while facing the anode electrode 1a. A plurality of gate electrodes 3c crosses the cathode electrodes 3a by interposing an insulating layer 3b. The gate electrodes 3c are also formed with a stripe pattern.

The insulating layer 3b has breakthrough holes 30b at the positions

where the cathode electrodes 3a and the gate electrodes 3c cross each other, and the gate electrodes 3c has also opening portions 30c at those positions. A microtip-based field emitter 3d is placed on the cathode electrode 3a within the area of each breakthrough hole 30b

5 A plurality of spacers 5 are held between the faceplate 1 and the backplate 3. The spacers 5 are positioned at the non-display area in the cell where light is intercepted by the black matrix 1c.

As shown in Fig. 2, the spacers 5 proceed along the short sides of the plates 1 and 3 parallel to each other. Of course, the spacers 5 may proceed along the long sides of the plates 1 and 3. A pair of alignment members 7 are integrally provided each at one-sided end portions of the spacers 5 to hold the spacers 5 at the non-display area in a constant manner.

Subsidiary alignment members 9 are integrally provided each at one-sided end portions of the alignment members 7 to further reinforce the holding state of the spacers 5.

That is, the alignment members 7 and the subsidiary alignment members 9 altogether form a rectangular frame, and this frame can serve to maintain the spacers 5 at proper places in a constant manner.

10 In the field emission display having the above spacer structure, after field emission components are provided between the plates 1 and 3, the plates 1 and 3 are sealed together to form a vacuum tight cell. The vacuum degree of the cell is controlled to be about  $10^{-7}$  through exhaustion.

However, in case the exhaustion process is performed in such a state



that the spacers 5, the alignment members 7 and the subsidiary alignment members 9 are mounted between the plates 1 and 3 in the longitudinal direction, it is difficult to expect fluent exhaustion due to the spacer components 5, 7 and 9.

Therefore, in this preferred embodiment, a plurality of exhaust grooves 5a are formed at each spacer 5 to realize fluent flowing of exhaust gas within the cell. The exhaust grooves 5a are arranged at the spacer 5 in the longitudinal direction while standing with the backplate 3. The exhaust grooves 5a are spaced apart from each other with a predetermined distance.

Furthermore, a plurality of image distortion preventing grooves 5b are formed at each spacer 5 while standing with the faceplate 1. The image distortion preventing grooves 5b are to reduce the contact area between the spacer 5 and the faceplate 1, thereby minimizing distortion of picture images due to the contact resistance. The image distortion preventing grooves 5b are spaced apart from each other with a predetermined distance in one to one correspondence with the exhaust grooves 5a.

The alignment members 7 and the subsidiary alignment members 9 are also provided with exhaust grooves 7a and 9a that are arranged in the longitudinal direction symmetrical to each other at both sides thereof. The exhaust grooves 7a or 9a are spaced apart from each other with a predetermined distance.

As shown in Fig. 3, in the fabrication process, the spacers 5 are mounted on the backplate 3 while being held by the alignment members 7 and

the subsidiary alignment members 9. At this time, the position control of the spacers 5 can be easily performed once for all due to the presence of the frame structure, and, after the mounting, the stable positioning thereof can be obtained.

5 In the meantime, the spacers 5, the alignment members 7 and the subsidiary alignment members 9 are formed with a photosensitive glass. The photosensitive glass is exposed to light through an appropriately patterned mask, the light-exposed glass is baked at the furnace, and the backed glass is etched to form the spacer structure with groove patterns.

10 Alternatively, in addition to field emission displays, the above structure may be applied to other flat panel displays such as flat cathode ray tubes.

As described above, in the inventive flat panel display, a plurality of spacers are easily positioned at the non-display area through one position controlling so that the production efficiency can be significantly enhanced.

15 While the present invention has been described in detail with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.

**WHAT IS CLAIMED IS:**

1. A flat panel display comprising:

a faceplate;

a backplate combined with the faceplate to form a vacuum tight cell;

an image production unit provided within the cell to produce display  
images from the cell;

a plurality of spacers mounted within the cell such that the spaces are  
placed at a non-display area, the spacers being held between the faceplate and  
the backplate; and

a pair of alignment members connected to the spacers in a body to  
align the spacers at the non-display area in a constant manner.

2. The flat panel display of claim 1 wherein each alignment  
member is connected to one-sided end portions of the spacers.

3. The flat panel display of claim 1 wherein the spacers are  
longitudinally placed along each one side of the plates parallel to each other.

4. The flat panel display of claim 1 further comprising a pair of  
subsidiary alignment members, the subsidiary alignment members are  
arranged perpendicular to the alignment members to form a rectangular frame.

5. The flat panel display of claim 1 wherein each spacer is  
provided with a plurality of exhaust grooves.

6. The flat panel display of claim 5 wherein the exhaust grooves  
are arranged at the spacer in the longitudinal direction while being spaced apart  
from each other with a predetermined distance.

7. The flat panel display of claim 5 wherein each spacer is provided with a plurality of grooves for preventing image distortion.

8. The flat panel display of claim 7 wherein the image distortion preventing grooves are arranged at the spacer in the longitudinal direction while being spaced apart from each other with a predetermined distance.

9. The flat panel display of claim 7 wherein the exhaust grooves and the image distortion preventing grooves are symmetrical to each other with respect to the longitudinal center line of the spacer.

10. The flat panel display of claim 1 wherein each alignment member is formed with a plurality of exhaust grooves.

11. The flat panel display of claim 10 wherein the exhaust grooves are arranged at the alignment member in the longitudinal direction.

12. The flat panel display of claim 11 wherein the exhaust grooves are arranged symmetrical to each other with respect to the longitudinal center line of the alignment member.

13. The flat panel display of claim 4 wherein each subsidiary alignment member is provided with a plurality of exhaust grooves.

14. The flat panel display of claim 13 wherein the exhaust grooves are arranged at the subsidiary alignment member in the longitudinal direction while being spaced apart from each other with a predetermined distance.

15. The flat panel display of claim 14 wherein the exhaust grooves are arranged symmetrical to each other with respect to the longitudinal center line of the subsidiary alignment member.

16. The flat panel display of claim 1 wherein the image production unit comprises:

a plurality of cathode electrodes formed at the backplate with a predetermined pattern;

an insulating layer formed at the backplate, the insulating layer having a plurality of breakthrough holes placed on the cathode electrodes;

a plurality of emitters contacting the cathode electrodes, each emitter being disposed within each breakthrough hole;

a plurality of gate electrodes formed on the insulating layer with a predetermined pattern, the gate electrodes having opening portions communicated with the breakthrough holes;

an anode electrode formed on the faceplate while facing the gate electrodes; and

a plurality of phosphor layers formed on the anode electrode with a predetermined pattern.

17. The flat panel display of claim 1 wherein the vacuum degree of the cell is kept to be  $10^{-7}$  torr.

### ABSTRACT OF THE DISCLOSURE

A flat panel display includes a faceplate, and a backplate combined with the faceplate to form a vacuum tight cell. An image production unit is provided within the cell to produce display images from the cell. A plurality of spacers are mounted within the cell such that the spaces are placed at a non-  
5 display area. The spacers are held between the faceplate and the backplate. A pair of alignment members are connected to the spacers in a body to align the spacers at the non-display area in a constant manner.

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FIG. 1

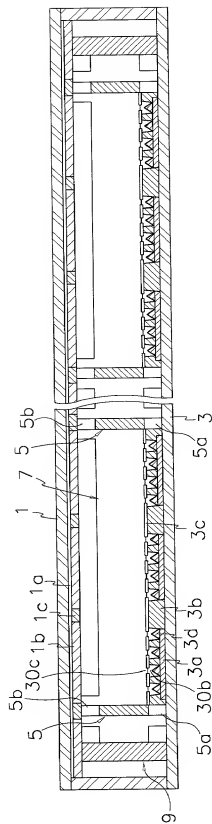


FIG.2

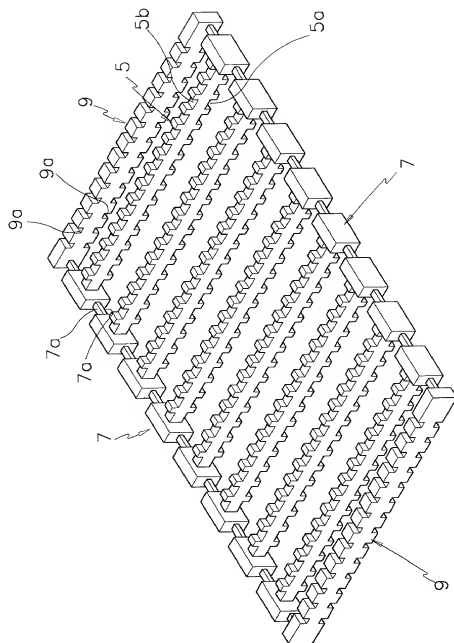
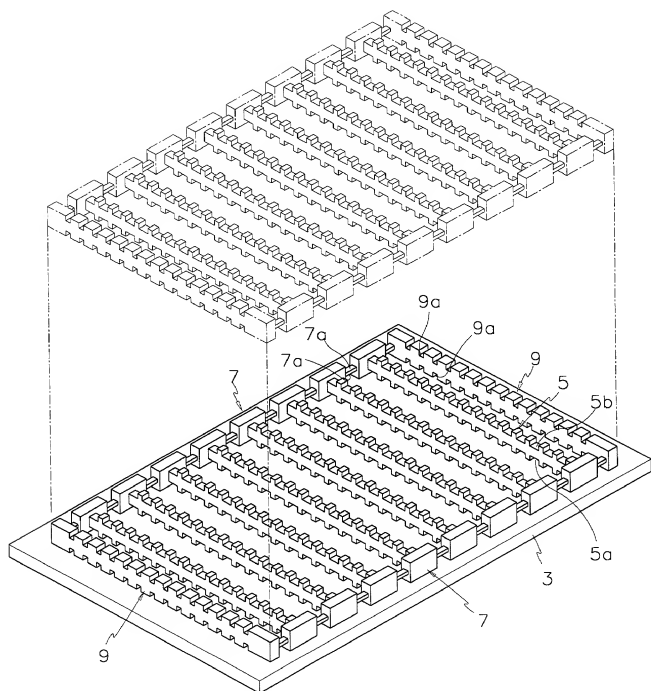




FIG.3



Rev. 4/97

DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATIONS

PATENT

Docket No.: 40055/DBP/Y35  
Attorney : D. Bruce Prout

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "**FLAT PANEL DISPLAY**", the specification of which is attached hereto unless the following is checked:

Was filed on \_\_\_\_\_ as United States Application Number or PCT International Application Number \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of the foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

## Prior Foreign Application(s)

Application Number	Country	Filing Date (day/month/year)	Priority Claimed
1999-34629	Korea	20/08/1999	Yes

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

Application Number	Filing Date
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I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

Application Number	Filing Date	Patented/Pending/Abandoned
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**POWER OF ATTORNEY:** I hereby appoint the following attorneys and agents of the law firm CHRISTIE, PARKER & HALE, LLP to prosecute this application and any international application under the Patent Cooperation Treaty based on it and to transact all business in the U.S. Patent and Trademark Office connected with either of them in accordance with instructions from the assignee of the entire interest in this application; or from the first or sole inventor named below in the event the application is not assigned; or from **YOU ME PATENT & LAW FIRM** in the event the power granted herein is for an application filed on behalf of a foreign attorney or agent.

**DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATIONS**

Docket No.: 40055/DBP/Y35


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The authority under this Power of Attorney of each person named above shall automatically terminate and be revoked upon such person ceasing to be a member or associate of or of counsel to that law firm.

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, 626/795-9900; 213/681-1800

**SEND CORRESPONDENCE TO :** CHRISTIE, PARKER & HALE, LLP, P.O. Box 7068, Pasadena, CA 91109-7068

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first joint inventor	Inventor's signature	Date
Yang-Woon Na		July 25, 2000
Residence and Post Office Address	Citizenship	
44-2, Mangpo-dong, Paldal-ku, Suwon-si, Kyungki-do, Korea	Korea	